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Abstract

PREPARATION OF UO_2 AND ThO_2-POWDERS IN THE SUBSIEVE RANGE

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In the course of the aqueous homogeneous suspension reactor program the need for UO_2 and ThO_2 powders with specific properties arose. The specifications that were to be met included: mean diameters varying from 4 - 10 μ, small standard deviation, low specific surface area, smooth and preferably spherical. Moreover the process should be of the once-through type (no recycle).

Three processes were developed that could meet the above mentioned requirements. It was shown, however, that the particle size could easily be varied, with the result that the processes can also be adapted to other requirements. Moreover it would seem that the processes are well suited to remote control and thus might be preferably used for the refabrication of fuel after reprocessing.

1. The process for ThO_2 or ThO_2-UO_2 mixed oxide is based on the emulsion-gelation ("sol-gel") method. According to this process a ThO_2-sol is dispersed in an organic liquid and the resulting droplets are subsequently gelled. After dehydration and filtration the particles are fired to obtain the low surface area powder. Although primarily developed to produce fuel for the suspension reactor, the process also proved to be applicable to the production of fuel particles with a size up to 1 mm.

2. The first process for the production of UO_2 is based on the precipitation of a basic uranyl-sulphate from a homogeneous

solution. Use is made of the slow hydrolysis of a partly neutralized uranyl-sulphate solution. After reduction and sintering of the precipitate a powder with a very narrow size distribution is obtained.

3. In the second method for the production of UO_2 urea delivers the precipitating NH_3 to a uranylnitrate solution.
With this process at least 8 different types of precipitate can be prepared. The chemistry of this urea process will be discussed in some detail.

One of the modifications, an amorphous one, was produced in a narrow size-range around 10 μ. The mean particle size can be varied by changing the rate of stirring during precipitation. Products with particle diameters up to 30 μ have been obtained.